

Review Article

Diverse ambulatory profiles in cerebral palsy: in-depth review

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ABSTRACT

The estimation of ambulation prognosis in cerebral palsy children poses a challenge for parents, caregivers, neurologists, and pediatric rehabilitation specialists despite its status as the primary cause of chronic disability in this demographic. Currently, a scale is developed for predicting ambulation in these children, making it imperative to anticipate their ambulatory potential. Research indicates that a child's gross motor skill development, such as achieving neck control by nine months, independent sitting by two years, crawling, and meeting other developmental milestones by thirty months, in addition to factors like postural reactions, cognitive abilities, infantile reflexes, and auditory and visual functions, serve as predictive indicators of ambulation. Moreover, even favourable upper limb functions in cerebral palsy contribute to prognosis of ambulation. The primary cause of chronic disability in pediatric population is cerebral palsy, and it can be challenging for pediatric rehabilitation specialists, neurologists, and parents to predict a child's prognosis for walking. The ambulation chart is available, which is developed by researcher, A Thai, who provided guidance on this matter. It is yet unknown how valid and reliable this tool is to serve as a predictor of ambulation in patients with cerebral palsy. To develop a suitable method for predicting ambulation in cerebral palsy that takes into account all the variables except those listed above, more research in this area is required.

Keywords: Cerebral palsy, Ambulation prediction, Prognostic factors

INTRODUCTION

When cerebral palsy was first described in 1861, was named as cerebral paresis or Little's sickness. There are different definitions of cerebral palsy were proposed later, depending on 2 pointers as presentations and etiologies. "Cerebral palsy (CP) describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain," according to a definition given by Peter Rosenbaum and colleagues. These patients' presents with physical difficulties, along with motor, sensory, communication, cognitive, behavior, perceptual, and/or

seizure disorders. This definition has incorporated all aspects of cerebral palsy.^{1,2} The prevalence rate of cerebral palsy (CP) in India is estimated to be approximately 3 cases per 1000 live births. Nevertheless, due to the country's status as a developing one, adequate data regarding the precise present prevalence rate of CP is not accessible. It is possible that over 25 lac children in India suffer with CP.³

The classification of cerebral palsy is actually a very challenging endeavor because each child with the condition may appear differently, making it challenging to diagnose cerebral palsy due to the heterogeneous presentation. According to Rosenbaum et al., there are

various factors that go into classifying cerebral palsy, such as motor impairments, anatomical and radiological findings, timelines, and causes. Review of prognostic factors and instruments for ambulation prediction in children with cerebral palsy - 3038 - accessible via the internet at <https://jazindia.com> occurrence Globally, the prevalence of CP is estimated by a population-based study to range from 1 to over 4 per 1,000 live births.⁴

CAUSES OF CEREBRAL PALSY

Damage to the developing brain, which may occur during or after birth, results in cerebral palsy. During the first year of life, the brain continues to develop at a quicker rate; hence, cerebral palsy may arise from prenatal, peri-natal, or postnatal causes. Of these, about 70–80% of cases are related to prenatal factors. The main factor contributing to the development of cerebral palsy is prolonged labor along with a delayed or absent birth cry and hypoxia. Cerebral palsy can also result from other factors such as low birth weight, early delivery before 32 weeks of pregnancy, neonatal jaundice, and others.

Infections such as meningitis, hyperbilirubinemia, bacterial or viral encephalitis, traffic accidents, falls, high grade fever, etc., can also cause brain injury within the first year of life. Another important factor in the development of cerebral palsy is persistent seizures.^{5,6} Cerebral palsy symptoms and indicators instead of just one disability, children with cerebral palsy may experience many disabilities such as learning problems, impaired two-point discrimination and loss of cortical sensations, impaired proprioception, neurological, musculoskeletal, oro-motor, speech and hearing, visual impairments, but mostly motor impairments. The accomplishment of all motor milestones is delayed as a result of these numerous deficits. Activities such as neck holding, rolling, sitting, crawling, standing, and walking come relatively slowly. Even daily chores, personal hygiene, and fine motor skills are delayed.⁷

The value of walking "Any bodily movement produced by skeletal muscles that requires energy expenditure" is what the World Health Organization defines as physical activity. Examples of this include walking for daily tasks or participating in sports.⁸ Physical activity has been shown to be crucial for all children to maintain their fitness and health, but ambulation is especially crucial for children with cerebral palsy (CP), as it might hinder their ability to perform daily tasks. The Gross Motor Function Classification System (GMFCS), a well-known objective technique, is used to classify ambulation in cerebral palsy. It comprises five levels: level I denotes a kid who is walking independently, and level V denotes complete dependence in a manual wheelchair.⁹

SIGNIFICANCE OF AMBULATION PREDICTION

The general term for abnormalities in posture and mobility is cerebral palsy. Following a cerebral palsy diagnosis, the majority of parents want to know if their kid will ever walk

or not. The parents wish to determine their child's lifetime demands as well as their future requirements. Effective resource management will be necessary for parents to meet their exceptional child's needs in accordance with his abilities. Therefore, from a parent's point of view, ambulation prognosis is the most significant factor.¹⁰ For rehabilitation specialists, ambulation prediction is crucial in determining the child's needs and enabling the achievement of therapeutic and rehabilitative objectives in line with those demands. Planning the child's therapeutic and rehabilitative care becomes more suitable once the likelihood of ambulation is determined.¹⁰⁻¹²

Currently, a scale is developed for predicting ambulation in these children, making it imperative to anticipate their ambulatory potential. Research indicates that a child's gross motor skill development, such as achieving neck control by nine months, independent sitting by two years, crawling, and meeting other developmental milestones by thirty months, in addition to factors like postural reactions, cognitive abilities, infantile reflexes, and auditory and visual functions, serve as predictive indicators of ambulation.¹³

A study on quadriplegic cerebral palsy has defined determinants of ambulation as mother undergoing multiple pregnancies associated with hypertension and diabetes and antibiotics use during pregnancy, birth weight less than 750g, seizures, encephalopathy during first 24 hours of neonatal period, hyperbilirubinemia etc.¹⁴ Bottos M, Gericke et al, studied achievement of ambulatory capacity for independent walking in adult in which the factors such as joint deterioration, pain have been noted as compensatory factors while physiological burnout, that is imbalance between physiological resources and environmental demands. Also, surgery is one of the important factors affecting ambulatory capacity. In pediatric population, primary factors are primitive reflexes & postural reactions, types of cerebral palsy, gross motor patterns and secondary factors are seizures, visual acuity, intellectual defect.¹⁵

Mathew et al and Laisram et al concluded that if child achieves independent sitting by 2 years of age and there is absence of other associated impairments is a good prognostic predictor of walking potential in children with cerebral palsy.¹⁶ While static postural control, reciprocal lower limb movement during crawling, child motivation, family support to child, and support to family did not predict independent walking, a sit-to-stand task—which is operationally defined as an indicator of functional strength—is predictive of taking three or more steps on one's own.¹⁷

These all above prognostic factors were evaluated for the prediction of ambulation in cerebral palsy patients and the scale was developed as scale for prediction of ambulation in Indian children with cerebral palsy-the SPAIC scale.¹⁸ Participants in this mixed-methods study included academic professionals, pediatric neurologists, pediatric

physiotherapists, pediatric rehabilitation specialists, parents, and children with cerebral palsy. Two rounds of targeted conversations were held after ten experts were invited to participate in the Delphi technique, taking into account a 1:10 item respondent ratio for factor analysis. After that, domains, an alpha scale version, and the first round of the Delphi questionnaire were developed and distributed to the experts. In Round 2, the Delphi questionnaire was assessed after a revised beta version was developed based on their recommendations. Cronbach's alpha was used for statistical analysis, and the scale was verified. The Scale for Prediction of Ambulation in Indian Children with CP (SPAIC) scale was validated and is suitable for use with additional data, to sum up.¹⁹

The child's activity level and social participation should be the therapist's primary focus, according to the World Health Organization (WHO). Therefore, it is crucial that therapists forecast their patients' ability to walk. Assessment of prognostic factors and instruments for ambulation prediction in children with cerebral palsy: A Review - 3039 - Accessible online at: <https://jazindia.com> and medical professionals' viewpoints to deliver more suitable services to the child in line with his requirements to enhance his socialization. Research on ambulation prediction. Finding the predictive markers for ambulation in children with cerebral palsy has been an ongoing study for a long time. Grant et al, provided an analysis of the literature in which they incorporated every relevant article published during the previous 50 years and discovered that some characteristics could predict a child's ability to walk when they had cerebral palsy. It has been determined that the predictive criteria for predicting ambulation in cerebral palsy children are postural reactions, gross motor skill accomplishment, and primitive or infantile reflex persistence.

However, prior to their assessment, there was no technology available that could forecast ambulation in individuals with cerebral palsy. In order to forecast the ambulation in cerebral palsy, Bleck introduced a scoring system in 1975. His approach used a range of 0 to +2, where +2 represents poor prognosis and 0 represents a good prognosis. Again, though, it has just taken into account reflexes and postural responses. Here, other considerations are not taken into account. In a correlational investigation, Hamazato et al, discovered that Bleck's score did not distinguish between the ambulatory and non-ambulatory quadriplegic cerebral palsy groups.

The majority of researches discovered that ambulation prognosis was significantly influenced by the attainment of developmental milestones. The likelihood that a child with cerebral palsy would be ambulatory is positively connected with the attainment of sitting milestones before or at the age of two, according to a few retrospective studies. According to one study, ambulation in children with cerebral palsy is predicted by the ability to hold one's neck at the age of nine months.^{11,12} Another study found that carrying weight on the upper extremities while prone

was a significant predictive factor. When it comes to predicting ambulation in people with cerebral palsy, reaching all other motor milestones up to crawling by the end of 30 months can also be viewed as a favourable predictor.

However, none of these studies have suggested a method to objectively predict a child's ability to walk when they have cerebral palsy that can be applied to all forms of the condition. The gross motor function categorization system and gross motor function measures are instruments to determine the child's current functional and gross motor state; however, they are neither prognostic in nature, nor do they take into account variables other than gross motor milestones for prediction of ambulation.²⁰⁻²²

According to the systematic review and meta-analysis on the prognostic factors of ambulation in cerebral palsy, the following factors were found to be positive prognostic factors for prediction of ambulation in cerebral palsy: achievement of gross motor milestones before 30 months, neck holding by 9 months, independent sitting by 2 years, weight bearing on upper extremity while in prone by 20 months, good upper extremity functions, good vision and hearing, and preserved intellectual functions.¹⁶ An ambulation chart that would forecast the degree of ambulation in Thai children with cerebral palsy was attempted to be developed by Keeratisiroj et al.²³

Each item on the chart had a scoring system, however it only assessed gross motor skills, hand-feeding proficiency, and infantile reflexes; environmental, family support, socioeconomic position, accessibility to orthotics, and other variables were not taken into account when predicting ambulation. Since these secondary variables are likewise crucial in predicting ambulation, we can take the necessary action if any of these secondary modifiable variables are discovered to be deficient. Furthermore, it is imperative that a tool be developed that takes into account both primary and secondary factors that affect a child's ability to walk when they have cerebral palsy.

CONCLUSION

This review concludes that neurology and rehabilitation professionals can use this material as an objective gauge to predict ambulation, assist parents, and arrange appropriate therapeutic and rehabilitative measures according to the needs of a patient with cerebral palsy.

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